Electronic Version
Stylesheet Version v1.1.1

Claims

[c1] 1. A silicon oxide gap-filling process, comprising:
providing a substrate having a trench thereon, wherein an aspect ratio of the trench is 4.0 at least; and
performing a CVD process having an etching effect to fill up the trench with silicon oxide, wherein reaction gases used in the CVD process comprise deposition gases and He/H_2 mixed gas as a sputtering-etching gas, wherein the percentage of the He/H_2 mixed gas in the total reaction gases is 70% at least.

[c2] 2. The silicon oxide gap-filling process of claim 1, wherein the CVD process comprises an HDP-CVD process.

[c3] 3. The silicon oxide gap-filling process of claim 1, wherein a ratio of He to H_2 (He/H_2 ratio) in the He/H_2 mixed gas is 0.3-4.0.

[c4] 4. The silicon oxide gap-filling process of claim 1, wherein an ED ratio of the CVD process is 0.1-0.03.

[c5] 5. The silicon oxide gap-filling process of claim 1, wherein the deposition gases comprise SiH_4 and O_2.

[c6] 6. The silicon oxide gap-filling process of claim 5, wherein in the CVD process, a flow rate of SiH_4 is 20-100sccm, a flow rate of O_2 is 40-200sccm, a flow rate of H_2 is 100-2000sccm, a flow rate of He is 200-2000sccm, a pressure is 5-20mTorr, a temperature is 400-650℃, a low-frequency RF power is 3000-15000W, and a high-frequency RF power is 500-5000W.

[c7] 7. The silicon oxide gap-filling process of claim 1, which is applied to an STI process in a 90nm semiconductor process.

[c8] 8. A silicon oxide gap-filling process, comprising:
providing a substrate having a trench thereon;
performing a CVD process having an etching effect to fill up the trench with silicon oxide, wherein reaction gases used in the CVD process comprise deposition gases and He/H_2 mixed gas as a sputtering-etching gas, and a percentage of the He/H_2 in the total reaction gases is raised with increase of an aspect ratio of the trench.

[c9] 9. The silicon oxide gap-filling process of claim 8, wherein the CVD process comprises an HDP-CVD process.

[c10] 10. The silicon oxide gap-filling process of claim 8,

which is applied to an STI process.

[c11] 11. The silicon oxide gap-filling process of claim 8, wherein the aspect ratio of the trench is higher than 3, and the ratio of He to H_2 (He/H_2 ratio) in the He/H_2 mixed gas is 0.3-4.0.

[c12] 12. The silicon oxide gap-filling process of claim 11, which is applied to an STI process in a semiconductor process under 0.13□m.

[c13] 13. The silicon oxide gap-filling process of claim 11, wherein an ED ratio of the CVD process is 0.1-0.03.

[c14] 14. The silicon oxide gap-filling process of claim 8, wherein the deposition gases comprise SiH_4 and O_2.

[c15] 15. The silicon oxide gap-filling process of claim 14 wherein in the CVD process, a flow rate of SiH_4 is 20-100sccm, a flow rate of O_2 is 40-200sccm, a flow rate of H_2 is 100-2000sccm, a flow rate of He is 200-2000sccm, a pressure is 5-20mTorr, a temperature is 400-650℃, a low-frequency RF power is 3000-15000W, and a high-frequency RF power is 500-5000W.

[c16] 16. A silicon oxide gap-filling process, comprising: providing a substrate having a trench thereon;

performing an HDP-CVD process to fill up the trench with silicon oxide, wherein

reaction gases used in the HDP-CVD process comprise SiH_4, O_2, He and H_2, wherein a flow rate of SiH_4 is 20-100sccm, a flow rate of O_2 is 40-200sccm, a flow rate of H_2 is 100-2000sccm, a flow rate of He is 200-2000sccm, a pressure is 5-20mTorr, a temperature is 400-650℃, a low-frequency RF power is 3000-15000W, and a high-frequency RF power is 500-5000W;

an ED ratio of the HDP-CVD process is 0.1-0.03; and

a percentage of the He/H_2 in the total reaction gases is raised with increase of an aspect ratio of the trench.

[c17] 17. The silicon oxide gap-filling process of claim 16, wherein the aspect ratio of the trench is higher than 3, and the ratio of He to H_2 (He/H_2 ratio) in the He/H_2 mixed gas is 0.3-4.0.

[c18] 18. The silicon oxide gap-filling process of claim 17, which is applied to an STI process in a semiconductor process under 0.13□m.

[c19] 19. The silicon oxide gap-filling process of claim 17, wherein the aspect ratio of the trench is 4.0 at least, and the percentage of the He/H_2 mixed gas is 70% at least.

[c20] 20. The silicon oxide gap-filling process of claim 19, which is applied to an STI process in a 90nm semiconductor process.